BE IT KNOWN that We, ***A. PAKHOMOV and T. GOLDBURT***, have invented certain new and useful improvements in

SEISMIC SENSOR

of which the following is a complete specification:

BACKGROUND OF THE INVENTION

The present invention relates generally to seismic sensors.

More particularly, it relates to electromagnetic seismic sensors. Electromagnetic seismic sensors are known in the art. One of the known electromagnetic seismic sensors includes a core with a winding which is movable in an electromagnetic field under the action of seismic activity, so that a corresponding electrical signal is produced and detected, which is indicative of the seismic activity. It is believed that the existing seismic sensors of the above mentioned general type can be further improved.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a seismic sensor which is a further improvement of the existing seismic sensors.

In keeping with these objects and with others which will become apparent hereinafter, one feature of the present invention resides, briefly stated, in a seismic sensor which has a pre-charged, non-conductive membrane which is located between two plates that form a capacitor, wherein one of the plates is fixed, while the other plate moves under the action of seismic activity, and an additional element which increases mass of the movable plate is provided.

When the seismic sensor is designed in accordance with the present invention, it has a very small volume, exhibits extremely high noise, immunity from electromagnetic interference, has increased sensitivity threshold and footstep detection range in low noise areas, and also has increased accuracy in footstep detection range.

The novel features which are considered as characteristic

for the present invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The single figure of the drawings is a view schematically showing a cross-section of a seismic sensor in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A seismic sensor in accordance with the present invention has a case which is identified with reference numeral 1. A lower support including a bottom plate 2 and a lower bush 3, and an upper support formed as an upper bush 4 are located in the case and immovably connected with the case, for example by glueing, welding, etc.

The sensor further has two plates 5 and 6 which together form a capacitor. The plate 5 is immovable relative to the support and therefore relative to the case of the sensor, while plate 6 is movable relative to the plate 5. For example, the plate 6 is formed as a flexible diaphragm. A pre-charged, non-conductive membrane is located between the plates 5 and 6. It can be composed, for example, from electret.

The plates 5 and 6 of the capacitor are electrically connected with the electronic unit 12 by conductors 8 and 9. Electronic unit 12 is connected with an electrical power supply through conductors 10 and 11.

The sensor is further provided with the element 13 which

locally increases the mass of the plate 6 which is formed as a diaphragm. The mass increasing element 13 can be formed for example, as a lug, which can be located centrally of the plate 6.

The electronic unit 12 can include an operational amplifier with high impedance input and any resistance and capacitance. The amplifier also place the role of an active filter. For protection from the electromagnetic interference the case 1 of the sensor can be formed as a double shield, with one shield composed of copper and the other shield composed of nickel. The double shield is needed in the case when the electromagnetic interference is very high. In other cases it is sufficient to use a single shield. The electromagnetic unit provides signal buffering, filtering, self-biasing, and external fandom biasing.

The sensor in accordance with the present invention operates in the following manner.

When the seismic sensor is accommodated in medium subjected to seismic activity, for example in the ground, then under the action of the seismic activity the sensor moves as a whole and the diaphragm 6 oscillates relative to the plate 5. The oscillations of the plate

6 are significantly enhanced by the mass increasing element 14.

The electrical signals produced by the capacitor 5, 6 are received in the electronic unit 12 which processes the signals and outputs an output signal indicative of the seismic activity detected by the seismic sensor, which is then to be evaluated.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in seismic sensor, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.